

# IT1205 – Computer Systems I

## INTRODUCTION

This is one of the 4 modules designed for Semester 1 of Bachelor of Information Technology Degree program.

**CREDITS:** 03

## LEARNING OUTCOMES

On completion of this course, students will have the fundamental knowledge to install, configure, maintain and troubleshoot a computer system.

## MINOR MODIFICATIONS

When minor modifications are made to this syllabus, those will be reflected in the Virtual Learning Environment (VLE) and the latest version can be downloaded from the relevant course page of VLE. Please inform your suggestions and comments through the VLE. <http://vle.bit.lk>

## ONLINE LEARNING MATERIALS AND ACTIVITIES

You can access all learning materials and this syllabus in the VLE: <http://vle.bit.lk>, if you are a registered student of BIT degree program. It is very important to participate in learning activities given in the VLE to learn this subject.

## ONLINE ASSIGNMENTS

The assignments consist of two quizzes, assignment quiz 1 (It covers the first half of the syllabus) and assignment quiz 2 (It covers the second half of the syllabus). Maximum mark for a question is 10, minimum mark for a question is 0 (irrespective of negative scores). Final assignment mark is calculated considering 40% of assignment quiz 1 and 60% of assignment quiz 2. Pass mark for the online assignments in a course is 50. You are advised to do online assignments before the final exam of the course. It is compulsory to pass all online assignments to partially qualify to obtain year 1 certificate.

## FINAL EXAMINATION

Final exam of the course will be held at the end of the semester. Each course in the semester 1 is evaluated using a two hour question paper which consists of 40-60 MCQs.

## OUTLINE OF SYLLABUS

Topics	Hours
1. Introduction	4
2. Data Representation and Arithmetic	6
3. Boolean Algebra and Digital Logic	6

4. CPU Organization and Instruction Set Architecture (ISA)	6
5. Input and Output Devices	6
6. Volatile and Non-Volatile Storage	8
7. Expansion Cards and System Interfaces	8
8. System Software and Utilities	6
9. Introduction to Networks	6
10. System Maintenance and Troubleshooting	4
<b>TOTAL</b>	<b>60</b>

## REQUIRED MATERIALS

### Main Reading:

**Student Manual** - VLE has a student manual for each section in this course.

### Supplementary Reading:

**Ref 1:** Linda Null and Julia Lobur, Computer Organization and Architecture, Jones and Bartlett 2006

**Ref 2:** Scott Mueller, Upgrading and Repairing PCs, 18th Edition, QUE Press 2008

**Ref 3:** Peter Norton, Introduction to Computers, 6th Edition, Tata McGraw-Hill 2005

## DETAILED SYLLABUS

### 1 Introduction (4 hrs)

#### Instructional Objectives

- Describe the main components of a computer system
- Describe the functionality of each of the main components of a computer system
- Review the evolution of computers from the mechanical computer to the UNIVAC
- Describe the features and use of supercomputers
- Describe the features and use of mainframe computers
- Describe the features and use of minicomputers
- Describe the features and use of workstations
- Describe the Von Neumann Architecture

**Sub Topics**

- 1.1 The Parts of a Computer System [Ref 1: pg. 25-27] [Ref 2: pg. 26, 33-36] [Student Manual - Section 1]
- 1.2 Evolution of Computers [Ref : 2 pg. 10-24] [Student Manual – Section 1]
  - 1.2.1. Key Developments
  - 1.2.2. The mechanical computer
  - 1.2.3. Electronic computers based on digital switching
  - 1.2.4. UNIVAC to the modern day computers
- 1.3. Modern day computers [Ref : 1 pg. 8-10] [Student Manual – Section 1]
  - 1.3.1. Supercomputers
  - 1.3.2. Mainframe computers
  - 1.3.3. Minicomputers
  - 1.3.4. Network Servers
  - 1.3.5. Personal computers and Micro computers[Ref : 1 pg.-5-7] [Student Manual-Section 1]
    - 1.3.5.1. Desktop computers
    - 1.3.5.2. Workstations
    - 1.3.5.3. Notebook computers and Tablet PCs
    - 1.3.5.4. Handheld personal computers
    - 1.3.5.5. Smart phones [Student Manual – Section 1]
- 1.4 The Von Neumann Model [Ref : 1 pg.-30-32]

**2. Data Representation and Arithmetic (6 hrs)****Instructional Objectives**

- Understand number systems in computers
- Understand methods of storage used for binary data
- Understand Representation of integer, fractional, floating point and character data
- Describe conversion methods for integer, signed integer, fractional and floating-point numbers
- Describe basic mathematical operations on signed integer and floating-point numbers

**Sub Topics**

- 2.1. Positioning Numbering Systems [Ref: 1 pg. 40]
- 2.2. Decimal to Binary Conversions [Ref: 1 pg. 40-46]
  - 2.2.1. Converting Unsigned Whole Numbers
  - 2.2.2. Converting Fractions
  - 2.2.3. Converting between Power-of-Two Radices
- 2.3. Signed Integer Representation [Ref: 1 pg. 46-62]
  - 2.3.1. Signed Magnitude
  - 2.3.2. Complement Systems
  - 2.3.3. Unsigned Versus Signed Numbers
  - 2.3.4. Carry versus Overflow
- 2.4. Floating-Point Representation [Ref: 1 pg. 63-71]
  - 2.4.1. A Simple Model
  - 2.4.2. Floating-Point Arithmetic
  - 2.4.3. Floating-Point Errors
  - 2.4.4. The IEEE-754 Floating Point Standard

- 2.4.5. Range, Precision, and Accuracy
- 2.4.6. Additional Problems with Floating-Point Numbers
- 2.5. Character Codes [Ref: 1 pg. 74-80]
  - 2.5.1. EBCDIC
  - 2.5.2. ASCII
  - 2.5.3. Extended ASCII
  - 2.5.4. UNICODE

### **3. Boolean Algebra and Digital Logic (6 hrs)**

#### **Instructional Objectives**

- Describe Truth Tables
- Describe Behavior of logic gates and combinatorial circuits
- Describe converting logic circuits into Boolean expressions (& vice versa)
- Describe manipulating expressions using Boolean algebra

#### **Sub Topics**

- 3.1 Boolean Algebra [Ref: 1 pg. 110-116]
  - 3.1.1 Boolean Expressions
  - 3.1.2 Boolean Identities
  - 3.1.3 Simplification of Boolean Expressions
  - 3.1.4 Simplification of Boolean Expressions using Karnaugh Maps
  - 3.1.5 Complements
  - 3.1.6 Representing Boolean Functions
- 3.2 Logic Gates [Ref: 1 pg. 118-120]
  - 3.2.1 Symbols for Logic Gates
  - 3.2.2 Universal Gates
  - 3.2.3 Multiple Input gates
- 3.3 Digital Components [Ref: 1 pg. 121-122]
  - 3.3.1 Digital Circuits and their relationship to Boolean Algebra
  - 3.3.2 Integrated Circuits

### **4. CPU Organization and Instruction Set Architecture (ISA) (6 hrs)**

#### **Instructional Objectives**

- Describe Computer Architecture
- Describe Components of a simple Central Processing Unit (CPU)
- Describe other Hardware components of a Computer
- Describe Features of Computers (Speed and Reliability)
- Describe Components and CPU Registers
- Describe Memory Organization
- Describe Fetch–decode–execute cycle and its use to execute instructions in a simple Computer
- Describe Instruction Sets – Definition and Features
- Describe Instruction Formats in a simple Computer

#### **Sub Topics**

- 4.1 CPU Basics and Organization [Ref : 1 pg.177-179]

- 4.2 The BUS [Ref : 1 pg.179]
- 4.3 Clocks [Ref : 1 pg.183-185]
- 4.4 Memory Organization and Addressing [Ref : 1 pg.186 -189]
- 4.5 Instruction Processing [Ref : 1 pg.198 -203]
- 4.6 Instruction sets – definition and features
  - 4.6.1 Instruction types [Ref : 1 pg.254-257]
  - 4.6.2 Operand organization
  - 4.6.3 Number of operands and instruction length [Ref : 1 pg.248-252]
  - 4.6.4 Addressing modes [Ref : 1 pg.257-261]
  - 4.6.5 Instruction execution – pipelining [Ref : 1 pg.261-266]
- 4.7 Features of machine instruction set
- 4.8 Instruction formats [Ref : 1 pg.243-254]

## 5. Input and Output Devices (6 hrs)

### Instructional Objectives

- Describe the functionality of various input devices
- Identify the different types of keyboards and layouts
- Describe how the inputs of a keyboard is read by the computer
- Identify different pointer devices
- Describe other input devices and their functionality
- Identify different optical input devices
- Identify different audiovisual input devices
- Identify the functionality of various output devices
- Identify different types of monitors
- Compare and contrast different types of monitors
- Identify the key features of a Multimedia projector
- Describe the key features of a sound system
- Identify different types of printers
- Compare and contrast different types of printers

### Sub Topics

- 5.1. Input Devices
  - 5.1.1. Keyboard [Ref 2: pg. 1059-1080] [Student Manual-Section 5]
    - 5.1.1.1. Standard keyboard layout
    - 5.1.1.2. Special keyboards
    - 5.1.1.3. How the computer accepts keyboard inputs
  - 5.1.2. Pointer devices [Ref 2: pg. 1081-1095]
    - 5.1.2.1. Mouse
    - 5.1.2.2. Trackball
    - 5.1.2.3. Touchpad
  - 5.1.3. Other devices [Ref 2: pg. 1096-1101]
    - 5.1.3.1. Pen
    - 5.1.3.2. Touch screen
    - 5.1.3.3. Joystick and Game Pad
  - 5.1.4. Optical devices [Student Manual -Section 5]
    - 5.1.4.1. Barcode readers
    - 5.1.4.2. Scanners and OCR devices
  - 5.1.5. Audiovisual devices [Student Manual -Section 5]
    - 5.1.5.1. Microphones

- 5.1.5.2. Video Input
- 5.1.5.3. Digital cameras
- 5.2. Output devices
  - 5.2.1. Monitors [Student Manual -Section 5]
    - 5.2.1.1. CRT
    - 5.2.1.2. Flat-Panel
    - 5.2.1.3. Other monitor types
  - 5.2.2. Multimedia projectors [Student manual -Section 5]
  - 5.2.3. Sound systems [Ref 1: pg.100-103] [Student manual-Section 5]
  - 5.2.4. Printers [Ref 1: pg.108-116] [Student Manual-Section 5]
    - 5.2.4.1. Dot matrix
    - 5.2.4.2. Ink Jet
    - 5.2.4.3. Laser Jet
    - 5.2.4.4. Other Printers
    - 5.2.4.5. Key features

## 6. Volatile and Non-volatile Storage (8 hrs)

### Instructional Objectives

- Identify different types of memory and their functionality
- Describe the functionality of the BIOS
- Identify different types of magnetic fixed and removable storage devices
- Describe different types of optical storage devices and different formats
- Describe different types of flash memory, their functionality and their appropriate usage
- Compare and contrast between different types of magnetic, optical and flash storage devices

### Sub Topics

- 6.1. BIOS [Ref 2: pg.441-444]
  - 6.1.1. BIOS concepts
  - 6.1.2. BIOS settings
- 6.2. Volatile storage (Memory) [Ref 2: pg.509-512, 513-515, 521-537] [Ref 1: pg.281-287]
  - 6.2.1. Memory types and their relevance to different applications
- 6.3. Non-volatile Storage Devices
  - 6.3.1. Magnetic Storage devices
    - 6.3.1.1. Fixed storage devices [Ref 1: pg.345-352]
      - 6.3.1.1.1. Hard Disks
    - 6.3.1.2. Removable storage devices [Ref 1: pg.351-352][Ref 2: 713-733]
      - 6.3.1.2.1. Floppy disks
      - 6.3.1.2.2. Magnetic drives
  - 6.3.2. Optical storage devices [Ref 1: pg.353-358] [Ref 2: 747-850]
    - 6.3.2.1. Compact Disk
      - 6.3.2.1.1. CD-R
      - 6.3.2.1.2. CD-RW
    - 6.3.2.2. Digital versatile Disk
      - 6.3.2.2.1. DVD-ROM
      - 6.3.2.2.2. DVD-R
      - 6.3.2.2.3. DVD-RW
      - 6.3.2.2.4. DVD+RW
      - 6.3.2.2.5. DVD+R
      - 6.3.2.2.6. DVD±R/RW and DVD-Multi Drives

- 6.3.3. Flash memory [Ref 2: pg.734-743]
  - 6.3.3.1. USB flash drive
  - 6.3.3.2. Secure Digital card and Multimedia card
  - 6.3.3.3. X-Picture card
  - 6.3.3.4. Compact Flash card
  - 6.3.3.5. Memory stick
- 6.4. Taking Backups [Student Manual]

## 7. Expansion Cards and System Interfaces (8 hrs)

### Instructional Objectives

- Identify expansion cards
- Describe the functionality of each of the expansion cards
- Identify the interfaces and describe their key parameters
- Compare and contrast different interfaces
- List usages and devices that connect to each interface

### Sub Topics

- 7.1. Expansion slots
  - 7.1.1. PCI [Ref 2: pg.399-404]
  - 7.1.2. ISA [Ref 2: pg.391-398]
  - 7.1.3. AGP [Ref 2: pg.405-408]
- 7.2. Expansion cards [Student Manual-Section 7]
  - 7.2.1. Graphics accelerator cards
  - 7.2.2. Sound card
  - 7.2.3. Network cards
  - 7.2.4. TV and Video capture card
  - 7.2.5. USB card and USB Hub
  - 7.2.6. Fire-wire card
- 7.3. Interfaces
  - 7.3.1. IDE with Master-slave setting [Ref 2: pg.581-584]
  - 7.3.2. SATA [Ref 2: pg.605-610]
  - 7.3.3. SCSI [Ref 2: pg.431]
  - 7.3.4. Standard Serial and Parallel port [Ref 2: 1046-1052][Ref 2: 1052-1057]
  - 7.3.5. Universal serial bus [Ref 2: pg.1031-1041]
  - 7.3.6. Fire-wire [Ref 2: pg.1042-1044]

## 8. System Software and Utilities (6 hrs)

### Instructional Objectives

- List the major Operating systems
- Describe the types of user interfaces in the operating system
- Describe the components of an operating system
- Install an operating system Linux/Windows
- Describe the functionality of a device driver
- Install devices (printer, soundcard, pen-drive, etc in Linux/Windows)
- Install applications on Linux/Windows

**Sub Topics**

- 8.1. System Software
  - 8.1.1. Operating system [Ref 3: pg.206-216]
    - 8.1.1.1. Types of Operating systems
    - 8.1.1.2. Providing a user interface
      - 8.1.1.2.1. Graphical User interface
      - 8.1.1.2.2. Command-Line Interface
    - 8.1.1.3. Running Programs
    - 8.1.1.4. Managing hardware
  - 8.1.2. Different Operating Systems [Ref 3: pg.225-235]
    - 8.1.2.1. DOS
    - 8.1.2.2. Windows 9x
    - 8.1.2.3. Windows 2000, XP, 2003, Vista
    - 8.1.2.4. UNIX
    - 8.1.2.5. Linux
    - 8.1.2.6. Mac Operating System
    - 8.1.2.7. OS X
    - 8.1.2.8. OS/2
    - 8.1.2.9. BSD
    - 8.1.2.10. Network Operating Systems
    - 8.1.2.11. Embedded Operating Systems
  - 8.1.3. Utilities [Ref 3: pg.216-218]
  - 8.1.4. Drivers and Device Installation with Windows [Student Manual-Section 8]

**9. Introduction to Networks (6 hrs)****Instructional Objectives**

- Identify and compare network devices and servers
- Identify and compare network transmission media, connections and protocols
- Compare and contrast different types of networks

**Sub Topics**

- 9.1. Uses of a Network [Ref 3: pg.244-248]
  - 9.1.1. Simultaneous access
  - 9.1.2. Sharing peripheral devices
  - 9.1.3. Communicate between computers
  - 9.1.4. backup data
- 9.2. Data communication media [Ref 3: pg.255-256] [Ref 2: pg.1153-1165]  
[Student Manual-Section 9]
  - 9.2.1. Wired Media
    - 9.2.1.1. Twisted-pair cable
    - 9.2.1.2. Coaxial cable
    - 9.2.1.3. Fiber-optic cable
  - 9.2.2. Wireless Media
    - 9.2.2.1. Microwave
    - 9.2.2.2. Cellular
    - 9.2.2.3. Infrared
- 9.3. Devices used to link computers [Ref 3: pg.256-257] [Student Manual-Section 9]
  - 9.3.1. Network Interface Card [Ref 2: pg.1167-1169]

- 9.3.2. Modem [Ref 2: pg.1137-1138]
- 9.3.3. Hubs [Ref 2: pg.1032-1033]
- 9.3.4. Bridge [Ref 2: pg. 1112]
- 9.3.5. Switch [Ref 2: pg.1182-1199]
- 9.3.6. Router
- 9.3.7. Gateways
- 9.4. Different Types of networks [Ref 3: pg.248] [Ref 2: pg.1152-1153] [Student Manual-Section 9]
  - 9.4.1. Personal Area Network
  - 9.4.2. Local Area Network
  - 9.4.3. Wide Area Network
- 9.5. Data Communication standards [Ref 3: pg.259-275] [Student Manual-Section 9]
  - 9.5.1. ISDN
  - 9.5.2. ADSL [Ref 2: 1111-1113]
  - 9.5.3. Ethernet [Ref 2: pg.1157-1158]
  - 9.5.4. Wi-Fi [Ref 2: pg.1160]
  - 9.5.5. Wi-max
  - 9.5.6. Bluetooth [Ref 2: pg.1099-1100][Ref 2: pg. 1165-1166]
- 9.6. Servers in a Network [Student Manual-Section 9]
  - 9.6.1. File Server
  - 9.6.2. Printer Server
  - 9.6.3. Web Server
  - 9.6.4. Mail Server
  - 9.6.5. Proxy Server

## 10. System Maintenance and Troubleshooting (4 hrs)

### Instructional Objectives

- Carryout maintenance task of a simple computer system
- Maintain and upgrade systems
- Troubleshoot systems

### Sub Topics

- 10.1. Maintenance guidelines [Ref 2: pg.1392-1411]
  - 10.1.1. PC Maintenance Tools
    - 10.1.1.1. Basic Tools
    - 10.1.1.2. Advanced Tools
  - 10.1.2. Safety
  - 10.1.3. Preventive Maintenance [Ref 2: 1409-1421]
    - 10.1.3.1. Active Preventive Maintenance
    - 10.1.3.2. Passive Preventive Maintenance
- 10.2. Troubleshooting guidelines [Ref 2: pg.1427-1433]
  - 10.2.1. Diagnostic software
    - 10.2.1.1. POST (Power on Self Test)
  - 10.2.2. Procedure to Make troubleshooting more successful
  - 10.2.3. Troubleshooting using deductive reasoning
    - 10.2.3.1. Reinstalling
    - 10.2.3.2. Replacing
    - 10.2.3.3. Building up the system while troubleshooting
- 10.3. Upgrading a system [Ref 2: pg.1295-1333]
  - 10.3.1. Upgradeability

10.3.2. Upgrading

10.3.3. Requirement Specific Upgrade

**PLATFORM**

Allow the student to maintain, upgrade and troubleshoot a standard computer system involving hardware, operating system, application software and external peripherals like printers, scanners etc.